WE CLAIM:

1. A method for monitoring an effect of administration of a parathyroid hormone to a subject, comprising:

determining a level of an enzyme indicative of an osteoblastic process of bone formation, a product of collagen biosynthesis, a product of collagen degradation, or a combination thereof in a biological sample from the subject; and

correlating the level determined with an effect of administration of a parathyroid hormone.

2. The method of claim 1, wherein the enzyme indicative of an osteoblastic process of bone formation comprises a bone specific alkaline phosphatase.

3. The method of claim 2, further comprising:

determining an elevated level of the bone specific alkaline phosphatase in the period just after initiation of administration; and

correlating the elevated level with the effect of the subject undergoing a desired response to administration of the parathyroid hormone.

4. The method of claim 3, wherein the period just after initiation of administration of the parathyroid hormone comprises a period of 0 to about 15 weeks after initiation of administration.

5. The method of claim 4, further comprising:

determining an elevated level of the bone specific alkaline phosphatase in a period subsequent to initiation of administration of the parathyroid hormone to the subject;

correlating the elevated level of the bone specific alkaline phosphatase with the effect of the subject undergoing a desired response to administration of the parathyroid hormone.

6. The method of claim 5, wherein the period subsequent to initiation of administration of the parathyroid hormone comprises a period of 0 to about 15 months after initiation of administration.

7. The method of claim 3, wherein the correlation indicates that the subject will benefit from continuing administration of the parathyroid hormone.

8. The method of claim 3, wherein the correlation distinguishes administering the parathyroid hormone from hormone replacement therapy or antiresorptive therapy.

9. The method of claim 5, wherein the correlation distinguishes administering the parathyroid hormone from hormone replacement therapy or antiresorptive therapy.

10. The method of claim 1, wherein the product of collagen biosynthesis comprises a procollagen I C-terminal propeptide

11. The method of claim 10, further comprising:

determining an elevated level of the procollagen I C-terminal propeptide in a period just after initiation of administration of the parathyroid hormone to the subject;

correlating the elevated level of the procollagen I C-terminal propeptide with the effect of the subject undergoing a desired response to administration of the parathyroid hormone.

12. The method of claim 1, wherein the elevated level of procollagen I C-terminal propeptide correlates with the response of spinal bone mineral density to administration of the parathyroid hormone.

13. The method of claim 1, wherein the period just after initiation of administration of the parathyroid hormone comprises a period of 0 to about 15 weeks after initiation of administration.

14. The method of claim 13, wherein the period comprises 0 to about 6 weeks.

15. The method of claim 11, wherein the level of the procollagen I C-terminal propeptide rises to a level of more than about 130% of a control level.

16. The method of claim 11, wherein the level of the procollagen I C-terminal propeptide in a subject rises to a level more than about 20 pM above the base line level in said subject.

17. The method of claim 10, further comprising:

determining that the level of the procollagen I C-terminal propeptide has increased to a peak level and subsequently declined in the period just after initiation of administration; and

correlating the increase to a peak level and subsequent decline with the effect of the subject undergoing a desired response to administration of the parathyroid hormone.

18. The method of claim 17, further comprising:

determining that the level of the procollagen I C-terminal propeptide has increased to a peak level and subsequently declined to at or near control levels in the period subsequent to initiation of administration; and

correlating the increase to a peak level and subsequent decline with the effect of the subject undergoing a desired response to administration of the parathyroid hormone.

19. The method of claim 11, wherein the correlation indicates that the subject will benefit from continuing administration of the parathyroid hormone.

20. The method of claim 11, wherein the correlation distinguishes administering the parathyroid hormone from hormone replacement therapy or antiresorptive therapy.

21. The method of claim 1, wherein the product of collagen degradation comprises an N-telopeptide.

22. The method of claim 21, further comprising:

determining that the level of N-telopeptide remains substantially constant in the period just after initiation of administration; and

correlating the substantially constant level with the effect of the subject undergoing a desired response to administration of the parathyroid hormone.

23. The method of claim 1, wherein the subject is a woman at risk of osteoporosis.

24. The method of claim 23, wherein the woman is not concurrently taking hormone replacement therapy or an antiresorptive.

25. The method of claim 1, wherein the subject is concurrently taking hormone replacement therapy.

26. A kit for monitoring an effect of administration of a parathyroid hormone to a subject, comprising in a container a reagent for determining a level of an enzyme indicative of an osteoblastic process of bone formation, a reagent for determining a level of a product of collagen biosynthesis, a reagent for determining a level of a product of collagen degradation, or a combination thereof; and instructions for said monitoring.

27. A method for using change in a biochemical marker of bone formation for predicting subsequent change in spine bone mineral density resulting from repetitive administration of a parathyroid hormone to a human subject, wherein said biochemical marker of bone formation is a product of collagen biosynthesis, said method comprising the steps of:

(a) determining the amount of difference for said subject between the level of said biochemical marker in a biological sample taken from said subject prior to administration of said hormone and the level of said biochemical marker in a sample taken from said subject after administration of said hormone begins;

(b) comparing the amount of difference for said subject determined in step (a) with known amounts of difference for other human subjects determined as in step (a) to find a known amount of difference for other human subjects that is about the same as said amount of difference for said subject, wherein

said parathyroid hormone has been administered to said other human subjects under the same conditions as for said subject, and

correlated amounts of subsequent change in spine bone mineral density resulting from administration of said parathyroid hormone under said same conditions are known for said known amounts of difference for other human subjects; and

(c) determining the known correlated amount of subsequent change in spine bone mineral density for said difference for said subject, thereby predicting that the subsequent change in spine bone mineral density due to said repetitive administration of a parathyroid hormone to said subject will be said known correlated amount of subsequent change in spine bone mineral density.

28. The method of claim 27 wherein said repetitive administration is daily administration, said parathyroid hormone is hPTH(1-34), said biochemical marker of bone formation is the product of collagen biosynthesis in serum known as procollagen I C-terminal peptide (PICP) and said biological sample taken after administration of said hormone begins is taken about one month after administration of said hormone begins.

29. The method of claim 28 wherein change in spinal bone mineral density is predicted for about one year after administration of said hormone begins.

30. The method of claim 29 further comprising a step in which the predicted dBMD determined in step (c) is adjusted for gender and age of said subjects.

31. The method of claim 30 further comprising a step in which the predicted dBMD determined in step (c) is adjusted for base line PICP level of said subjects before administration of said hormone begins.

32. The method of claim 31 wherein further:

when the base line level of PICP in a sample taken before said administration of said parathyroid hormone is defined as bPICP,

said difference in levels of PICP is defined as dPICP, and

said known correlated amount of subsequent change in spine bone mineral density is defined as dBMD; and

when said human subjects are female and bPICP < 100 pM, and

when dPICP <50 pM, then dBMD = 5.7%;

when dPICP = 50 - 99 pM, then dBMD = 9.5%;

when dPICP = 100 - 149 pM, then dBMD = 10.4%;

when dPICP $\geq$150 pM, then dBMD = 13.7%;

when said human subjects are female and bPICP $\geq$100 pM, and

when dPICP <50 pM, then dBMD = 9.0%;

when dPICP = 50 - 99 pM, then dBMD = 10.4%;

when dPICP = 100 - 149 pM, then dBMD = 12.6%;

when dPICP $\geq$150 pM, then dBMD = 18.5%;

when said human subjects are male and bPICP < 100 pM, and

when dPICP <50 pM, then dBMD = 4.8%;

when dPICP = 50 - 99 pM, then dBMD = 9.4%;

when dPICP = 100 - 149 pM, then dBMD = 11.1%;

when dPICP $\geq$150 pM, then dBMD = 10.7%;

when said human subjects are male and bPICP ≥100 pM, and

when dPICP <50 pM, then dBMD = 6.9%;

when dPICP = 50 - 99 pM, then dBMD = 8.7%;

when dPICP = 100 - 149 pM, then dBMD = 11.3%;

when dPICP ≥150 pM, then dBMD = 10.2%.

33. The method of claim 28 further comprising a step in which the predicted dBMD determined in step (c) is adjusted for concentration in bone-specific alkaline phosphatase determined at about 3 months after administration of said hormone begins.

34. A method for using change in a biochemical marker of bone formation for predicting subsequent change in spine bone mineral density resulting from repetitive administration of a parathyroid hormone to a human subject, wherein said biochemical marker of bone formation is an enzyme indicative of osteoblastic processes of bone formation, said method comprising the steps of:

(a) determining the concentration for said subject in a sample taken from said subject after administration of said hormone begins;

(b) comparing the concentration for said subject determined in step (a) with known concentrations for other human subjects determined as in step (a) to find a known concentration for other human subjects that is about the same as said concentration for said subject, wherein

said parathyroid hormone has been administered to said other human subjects under the same conditions as for said subject, and

correlated amounts of subsequent change in spine bone mineral density resulting from administration of said parathyroid hormone under said same conditions are known for said known concentrations for other human subjects; and

(c) determining the known correlated amount of subsequent change in spine bone mineral density for said concentration for said subject, thereby predicting that the subsequent change in spine bone mineral density due to said repetitive administration of a parathyroid hormone to said subject will be said known correlated amount of subsequent change in spine bone mineral density.

35. The method of claim 34 wherein said repetitive administration is daily administration, said parathyroid hormone is hPTH(1-34), said biochemical marker of bone formation is bone-specific alkaline phosphatase (BSAP) and said biological sample taken after administration of said hormone begins is taken about three months after administration of said hormone begins.

36. The method of claim 35 wherein change in spinal bone mineral density is predicted for about one year after administration of said hormone begins.

37. The method of claim 36 wherein further:

when BSAP concentration at 3 months is defined as BSAP(3), and

said known correlated amount of subsequent change in spine bone mineral density is defined as dBMD; and

when said human subjects are female, and

when BSAP(3) <10 pM, then dBMD = 7.2%;

when BSAP(3) = 10 – 14.99 pM, then dBMD = 9.4%;

when BSAP(3) = 15 – 19.99 pM, then dBMD = 12.2%;

when BSAP(3) $\geq$ 20 pM, then dBMD = 12.9%;

when said human subjects are male, and

when BSAP(3) <10 pM, then dBMD = 7.1%;

when BSAP(3) = 10 – 14.99 pM, then dBMD = 7.9%;

when BSAP(3) = 15 – 19.99 pM, then dBMD = 8.3%;

when BSAP(3) $\geq$ 20 pM, then dBMD = 10.0%.

38. A method for concurrently reducing the risk of both vertebral and non-vertebral bone fracture in a male human subject at risk of or having

osteoporosis, said method comprising

administering to said subject a parathyroid hormone consisting of amino acid sequence 1-34 of human parathyroid hormone

without concurrent administration of an antiresorptive agent other than vitamin D or calcium,

in a daily dose of at least about 15 μg to about 40 μg for at least about 12 months up to about 3 years.

39. The method of claim 38 wherein said human subject is at risk of or has osteoporosis arising from a hypogonadal condition.

40. The method of claim 39 wherein said hypogonadal condition is age-related.

41. The method of claim 38 wherein said osteoporosis is idiopathic.

42. The method of claim 38 wherein said daily dose is 20 μg or 40 μg.

43. The method of claim 38 wherein said daily dose is administered for at least about 24 months.

44. An article of manufacture comprising packaging material and a pharmaceutical composition contained within said packaging material, said composition comprising a parathyroid hormone consisting of amino acid sequence 1-34 of human parathyroid and

said packaging material comprising printed matter which indicates that

said composition is effective for concurrently reducing the risk of both vertebral and non-vertebral bone fracture in a male human subject at risk of or having osteoporosis when administered to said subject such that said parathyroid hormone is administered

without concurrent administration of an antiresorptive agent other than vitamin D or calcium,

in a daily dose of at least about 15 μg to about 40 μg for at least about 12 months to about 3 years.

45. Use of a parathyroid hormone consisting of amino acid sequence 1-34 of human parathyroid hormone for the manufacture of a medicament for concurrently reducing the risk of both vertebral and non-vertebral bone fracture in a male human subject at risk of or having osteoporosis,

wherein said medicament is administered to said subject without concurrent administration of an antiresorptive agent other than vitamin D or calcium,

in a daily dose of at least about 15 μg to about 40 μg for at least about 12 months up to about 3 years.

46. Use according to claim 45 wherein said medicament is contained within a packaging material,

said packaging material comprising printed matter which indicates that

said medicament is effective for concurrently reducing the risk of both vertebral and non-vertebral bone fracture in a male human subject at risk of or having osteoporosis when administered to said subject such that said parathyroid hormone is administered

without concurrent administration of an antiresorptive agent other than vitamin D or calcium,

in a daily dose of at least about 15 μg to about 40 μg for at least about 12 months up to about 3 years.